SHEAR CONNECTOR USING PERFORATED AND/OR CUT-OUT PLATE

Technical Field

The present invention relates to a shear connector used between a steel material and a concrete, and in particular to a shear connector using a perforated and/or cut-out plate.

Background Art

A combined structure used in architecture, or civil engineering field, etc. is designed with long span and high weight. Therefore, a desired strength is not achieved with only a pure steel structure, and a steel material needed is increased. Therefore, a constructed cross section or a material strength gets increased using a large mass concrete for thereby enhancing a weight resistance ability.

In particular, when a bending member is implemented using a combined structure, a shear connector is installed between a steel beam and a concrete slave for thereby achieving a mechanical adhering force (namely, shearing resistance) against a horizontal shear force.

Figure 5 is a view illustrating a beam member capable of supporting a

bending moment in such a manner that a H steel beam member 51 and a concrete slave 52 are formed integrally by a stud connector 53. The beam can be classified into a combined beam and a non-combined beam depending on the presence of a shear connector.

In the non-combined beam in which the shear connector is not installed between the concrete slave and steel material, there are a transformation state and a bending stress distribution with respect to an operation bending moment as shown in Figures 6a through 6c. At this time, it is assumed that a friction force between the concrete slave and the steel material surface is too weak, so that it can be neglected.

As shown therein, the concrete slave 52 and the steel beam 51 form neutral axes Z_s and Z_b, respectively and are bendable. At this time, a slip phenomenon may occur between the steel beam surface and the concrete. In addition, an uplift force f_{up} occurs at a contacting surface between the steel beam surface and the concrete.

Figures 7a through 7c are views illustrating a transformation state and a bending stress distribution with respect to an operation bending moment in a combined beam which the enough amount of shear connectors are installed at an upper side of the beam so that a slip phenomenon does not occur between the concrete slave and the steel beam.

The resistance at the cross section has an in-facial shear stress (horizontal shear force σ_h) and an out-facial shear force (vertical shear force σ_v, uplift force). Namely, a shear connector having the above two resistance functions should be provided in order to obtain a perfect combination between the concrete and the steel material.

Generally, a stud connector has been used as a shear connector in order to achieve a combined effect between the steel material and the concrete in architecture, or civil engineering field, etc., for thereby transferring an in-facial shear force between different materials.

In the stud connector, a circular head and a body are formed integrally. An arc stud welding machine is needed for a work at a construction site, or a factory, etc.

However, the arc stud welding needs 220V/380V (three-phase) voltage and over fixed rate current of 350~1000KA. Therefore, there are many problems in that it is impossible to obtain a fixed rate voltage or current at a remote area or a small size factory.

In addition, since the conventional stud connector has a small size head, a desired combination effect cannot be achieved in material separation prevention with respect to uplift force and an anchorage effect.

Furthermore, the anchorage effect may be decreased due to a frequent

vibration or fatigue weight load.

Disclosure of Invention

Accordingly, it is an object of the present invention to provide a shear connector having a perforated and/or cut-out plate capable of overcoming the problems encountered in the conventional art.

It is another object of the present invention to provide a shear connector having a perforated and/or cut-out plate capable of being easily constructed, achieving a perfect combination and a partial combination effect and enhancing a weight resistance ability and a resistance ability with respect to transformations in such a manner that a weight transfer function is provided between different materials.

It is further another object of the present invention to provide a shear connector having a perforated and/or cut-out plate capable of achieving the same resistance performances with respect to an in-facial shear stress and an out-facial shear stress.

To achieve the above objects, according to an aspect of the present invention, in a T-shaped steel plate having a predetermined length, there is provided a shear connector, comprising a flange and a web having a plurality of holes.

To achieve the above objects, according to other aspect of the present invention, in a T-shaped steel plate having a predetermined length, there is provided a shear connector, comprising a flange formed of a plurality of flange pieces cut-out in biased shapes, and a web having a plurality of holes.

To achieve the above objects, according to another aspect of the present invention, in a Z-shaped steel plate having a predetermined length, there is provided a shear connector, comprising an upper flange and a web having a plurality of through holes.

Therefore, in the present invention, a combination operation with a steel material is enhanced, so that a separation is prevented between concrete and a steel material, and thereby, a resistance with respect to a uplift operation and a facial shear resistance are enhanced.

Brief Description of Drawings

The present invention will become better understood with reference to the accompanying drawings which are given only by way of illustration and thus are not limitative of the present invention, wherein;

Figures 1a and 1b are perspective views of a shear connector according to a first embodiment of the present invention;

Figures 2a and 2b are perspective views of a shear connector according

to a second embodiment of the present invention;

Figures 3a and 3b are perspective views of a shear connector according to a third embodiment of the present invention;

Figure 4 is a perspective view of another example of a shear connector according to a first embodiment of the present invention;

Figure 5 is a partly cut-out perspective view of a beam member combination beam capable of resisting a bending moment in such a manner that a H-shaped beam member 51 and a concrete slave 52 are integrated using a stud connector 53;

Figures 6a through 6c are views illustrating a transformation state and a bending stress distribution in a non-combined beam in which a shear connector is not installed between a concrete slave and a steel beam; and

Figures 7a through 7c are views of a transformation state and a bending stress distribution with respect to an operation bending moment in a beam combined with a concrete slave wherein the enough amount of shear connectors are installed at an upper side of the steel beam so that a slip phenomenon does not occur between the concrete slave and the steel beam.

Best Mode for Carrying Out the Invention

The preferred embodiments of the present invention will be described

with reference to the accompanying drawings.

Figure 1a is a view of a shear connector 1 according to a first embodiment of the present invention. As shown therein, the shear connector 1 according to a first embodiment of the present invention is formed of a T-shaped steel having a flange 10 and a web 20. A plurality of through holes 12 and 22 are formed at the flange 10 and the web 20 at regular intervals.

Here, the through holes 12 and 22 are provided in order to increase a combining operation with concrete. As shown in Figure 1a, there are shown the shapes of the through holes 12 and 22. However, the shapes are not limited to the shapes of Figure 1a. The through holes 12 and 22 may be formed in a rectangular shape, a triangle shape and a diamond shape. In addition, in the case that a corner is formed at the through hole like a triangle shape, a rectangular shape and a diamond shape, as shown in Figure 1b, a rounding portion 14 is formed in order to prevent a certain fatigue breakdown by a corner stress concentration.

The through holes 12 and 22 formed in the flange 10 and the web 20 are designed to secure a continuity of the concrete and are capable of preventing a material separation based on a wedge function with respect to the horizontal and the vertical shear forces. In addition, reinforced steel may be inserted into the through holes 12 and 22, respectively. Here, the reinforced

steel is provided to enhance vertical and horizontal shear stresses. Namely, a brittleness property of the concrete is changed into a malleability property.

The flange 10 is provided in order to achieve a desired mounting effect with respect to an uplift force by limiting a flange lower concrete for thereby preventing a separation between the contacting surfaces of the materials.

Figures 2a and 2b are views illustrating a shear connector 2 according to second embodiment of the present invention. A plurality of through holes 22 are formed on the web 20. The plate forming the flange 10 is formed of a plurality of flange pieces 16 and 18 wherein the flange pieces are cut-out in a biased shape.

At this time, the construction that the flanges 10 are cut-out based on a biased method is provided in order to prevent the problems that the concrete is not effectively filled in the lower side of the flange after the concrete is filled. The brittleness breakage is prevented during the shearing resistance by slightly decreasing the strength of the flange. Therefore, the malleability property can be achieved.

In addition, the cut-out flanges 10 are capable of coping with the horizontal shear stresses by the wedge functions of the concrete.

The through holes 22 formed at the web 20 can be formed in various shapes like the first embodiment of the present invention. In the case that a

corner portion is formed at the through holes in a triangle shape, a rectangular shape, and a diamond shape, a fatigue breakage may occur by the corner stress concentration as shown in Figure 2b. Therefore, a rounding portion 14 is provided in order to decentralize the stress concentration.

Figures 3a and 3b are views illustrating a shear connector 3 according to third embodiment of the present invention. As shown therein, in a Z-shaped steel plate, a plurality of through holes are formed at an upper flange and a web. At this time, a lower flange 30 is designed to enhance the weldability for thereby achieving a stable adherence with the steel material.

In the preferred embodiments of the present invention, a plurality of protrusions (not shown) and/or grooves (not shown) can be formed at the web and the flange for thereby enhancing a friction force with the concrete.

As shown in Figure 4, the web 20 of the shear connector 1, 2 or 3 according to the present invention may be formed to have a plurality of ridges and valley portions in the shape of a wave. Therefore, it is possible to guide a small size breakage, not a big size breakage based on a pocket effect of concrete filled into the valley portions of the web 20.

Industrial Applicability

As described above, in the present invention, it is possible to achieve a

perfect combination and a partial combination effect between a steel material and concrete. In addition, a weight resistance ability and a resistance ability with respect to transformation are significantly enhanced in such a manner that a weight transfer function is provided between different materials.

The present invention is not limited to the above embodiments. As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described examples are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the meets and bounds of the claims, or equivalences of such meets and bounds are therefore intended to be embraced by the appended claims.